

Biomarker and Multimodal MRI Feature Associations in Alzheimer's Disease

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Introduction

- CSF and PET biomarkers support AD diagnosis but are invasive, costly or less scalable.
- Routine memory-clinic MRI may provide non-invasive signatures of AD-relevant biology and cognition.
- Multimodal MRI features were evaluated for diagnosis prediction and biomarker-informed endpoint analysis.

Clinical research value

- Non-invasive MRI signatures of AD-relevant endpoints.
- Feature-level interpretation for screening and monitoring workflows.

Methods

- Clinical memory-clinic data were linked with CSF biomarkers, cognitive scores, diagnostic labels, and multimodal MRI-derived features.
- 329 MRI features** were extracted across volumetric, diffusion, fMRI-connectivity, and cortical-thickness domains.
- Diagnosis** was modeled with Random Forest and stratified 10-fold cross-validation.
- Feature associations** with Abeta42, tau, MoCA, and MMSE **were ranked by absolute pairwise correlation**.

MRI feature domains

Volumetry, DTI tract metrics, fMRI connectivity analysis, Cortical thickness

Analysis endpoints

Diagnosis, Aβ42, Tau, MMSE/MoCA

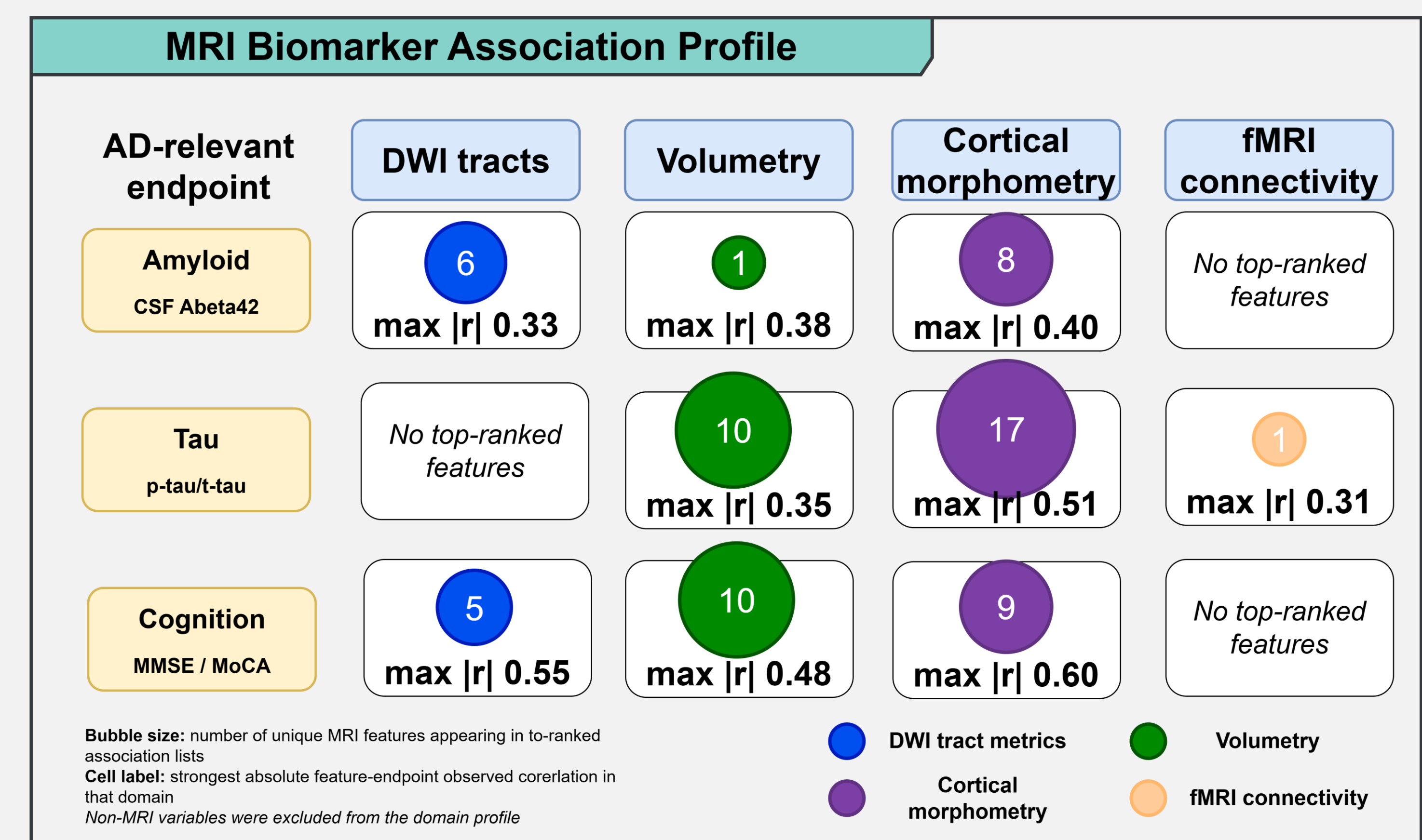
Methods

Random Forest, Correlation ranking

Results – Diagnosis prediction

- Random Forest classification achieved **mean F1=0.59** for AD diagnosis, with <5% performance drop on cross cohort analysis (ADNI)

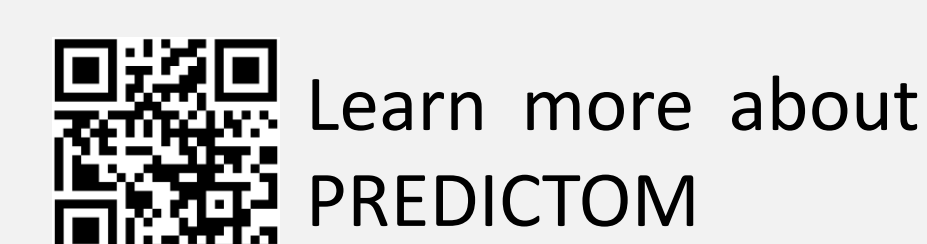
Results – Biomarker feature association



- Amyloid associations** involved DWI tract metrics and cortical morphometry, including uncinate and superior longitudinal fasciculus measures.
- Tau associations** were dominated by cortical morphometry and volumetric gray-matter features.
- Cognitive endpoints** showed a mixed signature involving DWI tract, hippocampal/amygdala, ventricular, and cortical measures.

Conclusion

- Multimodal MRI features may support non-invasive characterization of AD-relevant clinical and biological endpoints.
- Distinct amyloid, tau, and cognitive associations suggest complementary MRI signatures for scalable AD screening and monitoring.



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